

**PERANCANGAN SISTEM POMPA AIR TENAGA SURYA UNTUK
MEMENUHI KEBUTUHAN AIR TANAMAN JAGUNG DI BALAI BENIH
INDUK PALAWIJA GADING GUNUNGGKIDUL**

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INTISARI

Sektor pertanian menjadi bagian penting dalam memenuhi kebutuhan pangan dan untuk dapat memenuhi kebutuhan pangan diperlukan kecukupan kebutuhan air bagi pertanian seperti di Balai Benih Induk Palawija Gading. Balai Benih Induk Palawija Gading memiliki lahan tanam seluas 6 ha dengan 4 ha diantaranya dimanfaatkan untuk tanaman jagung. Maka diperlukan solusi berupa pompa air tenaga surya untuk memenuhi kebutuhan air pertanian bagi tanaman jagung dengan harga yang lebih terjangkau dari pompa tenaga diesel.

Sistem pompa tenaga surya dirancang dan disimulasikan menggunakan software PVSyst. Sistem menggunakan pompa Lorentz tipe *submersible* dengan sumber air berupa sumur bor berdiameter 5 inci dan kedalaman sumur mencapai 60 m. Konfigurasi terpilih yaitu pompa Lorentz PS2-4000 C-SJ8-15 dengan modul Longi LR5-72HPH-540M yang memiliki daya 540 Wp. Sistem menggunakan 12 modul surya dengan jam kerja selama 7 jam mulai dari jam 09.00 sampai jam 16.00.

Hasil yang diperoleh pada akhir masa sistem pompa bekerja yaitu sistem mampu memenuhi kebutuhan air dengan nilai *missing water* sebesar -0,2% yang artinya kebutuhan air terpenuhi bahkan berlebih, disertai nilai *performarce ratio* sebesar 35,5%, *energy at pump* sebesar 4629 kWh, dan *specific energy* sebesar 0,23 kWh/m³. Analisis ekonomi menunjukkan bahwa sistem terpilih layak untuk dijalankan ditunjukkan dengan nilai *Life Cycle Cost* sebesar Rp279.272.500, *Levelized Cost of Water* Rp707,2/m³, *Net Present Value* Rp72.242.817, dan *Payback Period* selama 12,57 tahun.

Kata kunci: Kebutuhan Air Tanaman Jagung, Pompa Tenaga Surya, PVSyst, Analisis Ekonomi

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DESIGN OF A SOLAR POWERED WATER PUMP SYSTEM TO MEET THE WATER NEEDS OF CORN CROPS AT THE PALAWIJA GADING GUNUNGKIDUL SEED CENTER

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ABSTRACT

Agricultural sector plays an important role in meeting food needs, and in order to meet food needs, sufficient water is required for agriculture, such as at the Gading Secondary Seed Center. The Gading Palawija Seed Center has 6 hectares of farmland, 4 hectares of which are used for corn cultivation. Therefore, a solution in the form of solar-powered water pumps is needed to meet the water requirements for corn cultivation at a more affordable price than diesel powered pumps.

The solar powered pump system was designed simulated using PVSyst software. The system uses a Lorentz submersible pump with a water source consisting of a 5-inch diameter borehole and a well depth of 60 m. The selected configuration is a Lorentz PS2-4000 C-SJ8-15 pump with a Longi LR5-72HPH-540M module that has a power of 540 Wp. The system uses 12 solar modules with 7 hours of operation from 9:00 a.m. to 4:00 p.m.

Results obtained at the end of the pump system's operation period show that the system was able to meet water demand with a missing water value of -0.2%, which means that water demand was met and even exceeded, accompanied by a performance ratio of 35.5%, energy at the pump of 4629 kWh, and specific energy of 0.23 kWh/m³. The economic analysis shows that the selected system is feasible to operate, as indicated by a Life Cycle Cost of IDR 279,272,500, a Levelized Cost of Water of IDR 707.2/m³, a Net Present Value of IDR 72,242,817, and a Payback Period of 12.57 years.

Keywords: Water Requirements for Corn Cultivation, Solar Powered Pump, PVSyst, Economic Analysis

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